

## WE CLAIM

1. A method of separating a quantity of slurry into slurry solids and slurry liquid to form a substantially dry filter cake comprising:

5 uniformly distributing said quantity of slurry in at least one filtration chamber;

introducing a hot gas fluid into said filtration chamber to displace slurry liquids from said slurry and to form said substantially dry filter cake, and

10 discharging said dry filter cake from said filtration chamber.

2. A method of separating a quantity of slurry into slurry solids and slurry liquid to form a substantially dry filter cake comprising:

15 uniformly distributing said quantity of slurry in at least one filtration chamber;

forcing a first portion of said liquid from said at least one filtration chamber with a first quantity of fluid to initiate formation of a filter cake of slurry solids within said chamber, and

20 passing a hot gas fluid through said filter cake to displace a further portion of said liquid from said filter cake to form said substantially dry filter cake, and

25 discharging said dry filter cake from said filtration chamber.

3. The method of claim 1 wherein said hot gas is steam.

4. The method of claim 3 wherein said steam is dry steam.

5. The method of claim 1 wherein said hot gas is hot air, hot inert gas or steam, or combinations thereof.

30 6. The method of claim 2 wherein said hot gas or hot air, hot inert gas or steam, or combinations thereof, is passed through said filter cake in a sequence of individual selection of hot air, hot inert gas or steam, or combinations thereof, in an order determined by an initial analysis of the slurry to be separated into slurry solids and slurry liquid.

35 7. The method of claim 2 wherein said slurry is initially pretreated with heat from hot air, hot inert gas or steam, or combinations thereof, while being uniformly distributed in

said filter chamber.

8. The method of claim 1 or 2 using hot wash fluid.

9. The method of claim 2 wherein said filter chamber is preheated prior to having said slurry uniformly distributed therein.

5 10. The method of claim 1, 2 or 9 wherein said filter chamber is pressurized with hot gas, hot inert gas, steam, or combinations thereof, prior to having said slurry uniformly distributed therein.

10 11. The method of claim 6 wherein said sequence of passing hot air, hot inert gas or steam, or combinations thereof, through said filter cake is a repeated sequence of selected hot air, hot inert gas or steam, or combinations thereof.

15 12. The method of claim 1 with the additional step of passing air or gas through said cake after said hot gas to cool said cake prior to discharging said dry filter cake from said chamber.

20 13. The method of claim 1 wherein said fluid displaced from said filter chamber is recirculated into contact with said slurry or hot gas to transfer heat from said slurry fluid to preheat said slurry or hot gas.

14. The method of claim 1 wherein said hot gas is hot air, hot gas or steam elevated temperature and pressure within said filter chamber and when exiting from said chamber.

25 15. The method of claim 14 wherein said hot gas is at a temperature of about 80°C to about 230°C.

16. The method of claim 14 wherein said hot gas is at a pressure between about -8.0 psi to about 400 psi.

30 17. The method of claim 1 wherein said hot gas is selected by analysis of said slurry to be separated so as to prevent unwanted structural changes in said slurry solids in said cake formed in said chamber.

35 18. The method of claim 1 wherein means are provided in or associated with said chamber for sensing conditions of temperature, pressure and cake formed condition, or combinations thereof, for controlling the distribution of said slurry in said chamber and for controlling the introduction of said hot gas fluid to said chamber.

19. The method of claim 18 including controlling said

distribution of slurry into said chamber and said passing of said hot gas fluid in accord with said sensed conditions within said chamber.

20. The method of claim 1 including the step of sealing said chamber prior to distribution of said slurry, and then elevating the pressure in said sealed chamber to a predetermined pressure.

21. The method of claim 1 wherein said at least one filtration chamber has a plurality of input ports and exit ports for selectively entering said slurry or said hot gas into said chamber and for exiting liquids and hot gas from said chamber.

22. A pressure filter apparatus for separating a slurry into slurry liquid and slurry solids and for forming a substantially dry slurry solids cake from said slurry comprising:

at least one filtration chamber,

a source of slurry coupled with said at least one filtration chamber,

at least one source of fluid coupled with said at least one filtration chamber,

separate valving means for controlling entry of said slurry and said fluid into said at least one filtration chamber,

means for controlling said separate valving means to uniformly distribute said slurry into said filtration chamber and for introducing said fluid into said filtration chamber for separating slurry liquid from said slurry to form said slurry solids cake,

and means for discharging said slurry solids cake from said apparatus.

23. The apparatus of claim 22 wherein said at least one source of fluid coupled to said at least one filtration chamber includes a source of hot gas.

24. The apparatus of claim 23 wherein said source of hot gas includes hot air, hot inert gas, or stream, or combinations thereof.

25. The apparatus of claim 23 including a steam source that produces steam at elevated pressure and temperature.

26. The apparatus of claim 22 wherein said means for

controlling said valving means is a programmable controller that can be programmed to pass said at least one source of fluid into said at least one filtration chamber in a desired sequence of any one or all of the following steps:

- 5           initiating the formation of a filter cake,
- dewatering said cake,
- washing said cake,
- changing the temperature of said cake, or
- discharging said cake from filter apparatus.

10       27. The apparatus of claim 22 wherein said apparatus includes means for coupling said separated slurry liquids with at least one of said source of slurry or said source of fluid to pretreat said sources prior to entry into said filter apparatus.

15       28. The apparatus of claim 22 wherein said source of fluid coupled to said at least one filtration chamber is applied to said filtration chamber prior to distribution of said slurry into said chamber to pretreat said chamber.

20       29. The apparatus of claim 28 wherein said source of fluid is steam and said chamber is preheated by said steam prior to distribution of said slurry.

25       30. The apparatus of claim 26 wherein said programmable controller is programmed to apply hot air, hot inert gas or steam, or combinations thereof, in preprogrammed sequences to produce said substantially dry cake.

30       31. The apparatus of claim 22 wherein a source of compressed air, a source of inert gas, and a steam source are connected to said apparatus and said source of fluid is coupled with said source of compressed air, source of inert gas and steam source to coordinate pressure, temperature and conditions within said at least one filter chamber with conditions in said source of compressed air, source of inert gas and steam source.

35       32. The apparatus of claim 22 with the addition of means for supplying wash fluids to said at least one filtration chamber for treating said substantially dry filter cake.

35       33. The apparatus of claim 22 including a filter medium disposed within said at least one filtration chamber for supporting said substantially dry filter cake,

          means for transporting said filter medium through said filtration chamber, and

means for cleaning said filter medium.

34. The apparatus of claim 33 wherein said cleaning means is a driven brush mechanism that contacts said filter medium.

5 35. The apparatus of claim 33 wherein said cleaning means includes a source of fluids for cleaning and treating said filter medium.

36. The apparatus of claim 22 including vibrator means connected to said at least one filter chamber for vibrating said chamber during said discharge of said cake from said apparatus.

10 37. The apparatus of claim 22 wherein said apparatus includes:

a plurality of filtration chambers in operating cooperation,

15 said source of slurry is coupled to each of said plurality of chambers,

said source of fluid is coupled to each of said chambers, said separate valving means includes valving means associated with each of said chambers, and

20 said means for discharging said cake from said chamber is coupled to each of said chambers.

38. A pressure filter apparatus for separating a slurry into slurry liquid and slurry solids and for forming a substantially dry slurry solids cake from said slurry comprising:

25 at least one dual sided filtration chamber including filter media on both sides of said chamber,

slurry input means connected to said chamber between said filter media,

30 at least one source of fluid coupled to said chamber and between said filter media, said source including hot gas, inert gas and steam, or combinations thereof,

a flexible diaphragm in cooperating engagement with said filter media,

35 and fluid means coupled to said flexible diaphragm for squeezing said diaphragm against said filter media for removing liquids from said slurry within said chamber and for forming said substantially dry filter cake.